Claims

1. Method for generating an atmospheric pressure glow discharge plasma (APG), wherein a plurality of electrodes are arranged defining a discharge space for forming said plasma, wherein said electrodes are connected to a power supply and an AC-voltage is applied to said electrodes, and wherein a gaseous substance is provided in said discharge space, wherein said AC-voltage applied to said electrodes has an amplitude equal to at least the breakdown voltage of said gaseous substance and has a frequency of at least 50 kHz, and said gaseous substance essentially comprises at least one of a group comprising argon, nitrogen and air.

2. Method according to claim 1, wherein said AC-voltage amplitude is less than or equal to approximately 140% of said breakdown voltage.

3. Method according to claim 2, wherein said AC-voltage amplitude is between 110% and 120% of said breakdown voltage.

4. Method according to any of the previous claims, wherein the temperature of said gaseous substance is lower than 100°C.

5. Method according to any of the previous claims, wherein at least one further gas is provided to said gaseous substance in said discharge space.

6. Method according to claim 5, comprising at least the steps of:

providing said further gas to said discharge space after essentially stabilising said plasma such that the concentration of said further gas is fractionally increased stepwise; and

stabilizing said plasma by adjusting said AC-voltage after each stepwise increment of said concentration of said further gas.

7. Method according to any of the claims 5 and 6, wherein said at least one further gas is provided to said gaseous substance in a

concentration of at most 50% by volume.

8. Method according to claim 7, wherein said concentration is at most 20% by volume.

9. Method according to any of the claims 5-8, wherein said at least one further gas provided to said gaseous substance in said discharge space is comprised of at least one of a group of O_2, CO_2, NH_3, common precursor gasses such as SiH_4, hydrocarbons, organosilicons such as TEOS and HMDSO, or organo-metallics and combinations thereof.

10. Method according to any of the previous claims, wherein said gaseous substance provided in said discharge space is flowed through said discharge space, establishing a gas flow.

11. Method according to claim 10, wherein said gas flow has a flow rate in a range of 1 l/min to 50 l/min.

12. Method according to any of the claims 10 and 11, wherein the velocity of the gas flow is in the range of 0.1 - 10 m/s.

13. Method according to claim 12, wherein the velocity of the gas flow is in the range of 1 - 5 m/s.

14. Method according to any of the previous claims, wherein said AC-voltage is chosen to comprise a frequency less than 1 MHz.

15. Method according to claim 14, wherein said frequency of the AC-voltage is chosen within a range of 100 kHz to 700 kHz.

16. Method according to any of the previous claims used for treating a polymer film, wherein a residence time of said thermoplastic polymer film in said discharge space is chosen such that said thermoplastic polymer film is kept at a temperature below said glass transition temperature of said thermoplastic polymer film.

17. Method according to claim 16, wherein said residence time is controlled by moving said film through said discharge space and controlling the velocity of said film.

18. Method according to any of the previous claims used for treating a polymer film, wherein the amplitude of said AC-voltage is

chosen such that the temperature of the discharge space remains below a glass transition temperature of said thermoplastic polymer film during treatment of said film and for maintaining said glow plasma.

19. Method according to any of the claims 16-18, wherein said thermoplastic polymer film comprises at least one of a group comprising triacetyl cellulose (TAC), polyethyleneterephthalate (PET), polyethylene-naphthalate (PEN) and similar thermoplastic polymers.

20. Method according to any of the previous claims, wherein at least one of said electrodes is covered with a film of dielectric material.

21. Method according to claim 20, wherein said film of dielectric material is chosen comprising a thickness in a range of 1 µm to 1000 µm.

22. Method according to claim 21, wherein said thickness lies within a range of 250 µm to 500 µm.

23. Method according to any of the previous claims, wherein at least two of said electrodes are spaced apart from each other over a distance within a range of 100 µm to 5000 µm.

24. Method according to claim 23, wherein said distance is chosen within a range of 250 µm to 1500 µm.

25. Method according to any of the previous claims, wherein a voltage rise time defines a shortest time interval for said AC-voltage to reach its maximum value starting from zero, and wherein said voltage rise time of the AC-voltage is in the range of 0.1 to 10 kV/µs.

26. Method according to any of the previous claims, wherein current density through said plasma is less than 10 mA/cm^2.

27. Method according to any of the previous claims, used for treating a substrate in said discharge space with a chemical vapour deposition process using said plasma.

28. Arrangement for generating an atmospheric pressure glow discharge plasma (APG), comprising a plurality of electrodes arranged

such that a discharge space is defined by said electrodes, further comprising means for applying an AC-voltage to said electrodes, and means for providing a gaseous substance to said discharge space, wherein said means for applying an AC-voltage to said electrodes are arranged for applying an AC-voltage having an amplitude equal to at least a breakdown voltage of said gaseous substance and having a frequency of at least 50 kHz, and said means for providing a gaseous substance to said discharge space are arranged for essentially providing at least one of a group comprising argon, nitrogen and air having a temperature lower than 100°C.

29. Arrangement according to claim 28, wherein said means for applying an AC-voltage are arranged for providing an AC-voltage having amplitude up to 140% of said breakdown voltage.

30. Arrangement according to any of the claims 28 or 39, wherein said means for providing a gaseous substance are arranged for providing at least one further gas to said gaseous substance in said discharge space.

31. Arrangement according to claim 30, wherein said means for providing a gaseous substance are further arranged for providing the at least one further gas such that the concentration of said at least one further gas is stepwise adjustable.

32. Arrangement according to any of the claims 30 or 31, wherein said at least one further gas comprises one of a group of O_2, CO_2, NH_3, common precursor gasses such as SiH_4, hydrocarbons, organosilicons such as TEOS and HMDSO, or organo-metallics and combinations thereof.

33. Arrangement according to any of the claims 28-31, comprising means for flowing said gaseous substance through said discharge space.

34. Arrangement according to claim 32, wherein said means for flowing said gaseous substance through said discharge space is arranged

for establishing a flow with a flow rate within a range of 1 l/min to 50 l/min.

35. Arrangement according to claim 34, wherein said means for flowing said gaseous substance through said discharge space is arranged for establishing a flow with a flow velocity within a range of 0.1 - 10 m/s.

36. Arrangement according to any of the claims 28-35, wherein said means for applying a high frequency AC-voltage is arranged for applying a voltage comprising a frequency within a range of 50 kHz to 1 MHz.

37. Arrangement according to any of the claims 28-36, wherein at least one of said electrodes is arranged for supporting a thermoplastic polymer film to be treated by said plasma.

38. Arrangement according to any of the claims 37, further comprising means arranged for moving said thermoplastic polymer film through said discharge space with a velocity for which the residence time of said film is such that the film is kept at a temperature below said glass transition temperature of said thermoplastic polymer film.

39. Arrangement according to any of the claims 37 or 38, wherein said means for applying an AC-voltage are arranged for providing an AC-voltage having an amplitude such that the temperature of the discharge space remains below a glass transition temperature of said thermoplastic polymer film during treatment of said film.

40. Arrangement according to any of the claims 28-39, comprising a film of dielectric material contiguous to at least one of said electrodes.

41. Arrangement according to claim 40, wherein said film of dielectric material comprises a thickness in a range of 1 μm to 1000 μm.

42. Arrangement according to any of the claims 28-41, wherein said discharge space comprises dimensions defined by a spacing between said electrodes and said dimensions are within a range of 0.1 mm to 5 mm.

43. Arrangement according to any of the claims 28-42, arranged for adjusting the shortest time interval for said AC-voltage to reach its maximum value starting from zero, and wherein said adjusting can be performed at least in a range of 0.1 to 10 kV/μs.

44. Arrangement according to any of the claims 28-43, arranged for adjusting the current density through said plasma in a range below 10 mA/cm^2.

45. Arrangement according to any of the claims 28-44, comprising a current choke coil arranged for stabilising said plasma.

46. Arrangement according to any of the previous claims, said arrangement being arranged for performing a chemical vapour deposition treatment process on a substrate in said discharge space using said plasma.